USGS NSF GRIP Opportunity

USGS Center:	Illinois Water Science Center
Project Title:	Estimating total uncertainty in streamflow predictions in ungaged catchments from a regionally-calibrated continuous-simulation rainfall-runoff model in an urban setting
Project Hypothesis or Objectives:	Over the last few decades, the USGS Illinois Water Science Center has been assisting the US Army Corps of Engineers (USACE) - Chicago District in measuring the diversion of water by the State of Illinois from Lake Michigan into the Illinois River and thus out of the Great Lakes basin, which is limited by Supreme Court decree. The USGS scope includes streamflow measurements using advanced instrumentation and improving the regional calibration of the continuous-simulation rainfall-runoff model HSPF for prediction of the runoff volume from ungaged areas. As is being increasingly recognized, environmental predictions are incomplete without an accompanying estimate of uncertainty, and the USACE has asked us to estimate the total uncertainty of the HSPF streamflow predictions. This total uncertainty includes effects of input errors such as precipitation, model and calibration errors, errors in the streamflow data used for model calibration, and finally errors in the transfer of the predictions from gaged to ungaged basins. Methodologies for determining streamflow prediction uncertainty remain an area of active research with many associated practical and theoretical challenges. The objectives of the proposed study is two-fold: • Using the Lake Michigan Diversion HSPF model with its associated datasets as a case study, develop a methodology for estimating the total uncertainty of its predictions in ungaged basins. • Demonstrate the practicality of the develop methodology by applying it to estimate the daily and annual streamflow uncertainty for the Lake Michigan diversion HSPF predictions.
Duration:	12 months
Internship Location:	Urbana, Illinois

Area of Discipline:	Hydrology, statistics (Civil Engineering)
Expected Outcome:	The project is expected to achieve the development of a general approach to the problem of the estimation of the total uncertainty of streamflow predictions in ungaged basins made by continuous simulation models and to provide an application of this approach to the Lake Michigan diversion modeling problem. As a general problem of great importance to practical hydrologic prediction, these results will benefit the intern in their future career, this and other hydrologic modeling projects throughout the USGS, and the stakeholders in the Lake Michigan diversion system, including the USACE and the State of Illinois. Peer-reviewed publication is anticipated. Working in a USGS Water Science Center with the hydrologists and technicians who make streamflow measurements will also provide an important window on the properties of these data which form the basis of most studies of watershed hydrology in the US.
Special skills/training Required:	The intern is expected to have training in watershed hydrology, hydrologic model calibration, statistical hydrology, and computer programming (R preferred).
Duties/Responsibilities:	The list below is comprehensive of the whole study. The Intern will select, in consultation with the Principal Investigators, one or two of the elements as matches his/her interests and background. • Documenting methodologies for estimating uncertainty in various components of the model system as mentioned above, • Conducting an error analysis of streamflow measurements based on various technologies, • Conducting error analysis of precipitation measurements, in this case, a 25-gage network system, and of other meteorological data, • Conduct predictive uncertainty analysis of the HSPF model predictions with existing regional parameter sets, and • Synthesize a methodology for determining the total uncertainty in the rainfall-runoff model predictions.
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